

Trypanosome Diseases of Domestic Animals in Nyasaland.

III. — *Trypanosoma pecorum*. *Development in Glossina morsitans.*

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[PLATE 2.]

INTRODUCTION.

In a previous paper* the morphology of this species of trypanosome and its action on animals were described. In this it is intended to give an account of its development in *Glossina morsitans*.

This trypanosome belongs to the group in which the development takes place first in the gut, then passes forward into the labial cavity of the proboscis, and finally reaches the hypopharynx, where the trypanosomes revert to the original "blood-forms" and become infective. There is no infection of the salivary glands.

THE DEVELOPMENT OF *T. PECORUM* IN *G. MORSITANS*.

Seven experiments were carried out with laboratory-bred flies. Five were positive and two negative.

Table I.—Laboratory-bred Flies.

Date.	Expt.	No. of flies used.	Expt. positive or negative.	No. of infected flies found.	No. of days before flies became infective.	Mean temperature.
1912.						
May 16...	546	22	+	4	53	69° F. (20·5° C.).
July 2...	524	20	+	2	37	65° F. (18·3° C.).
1913.						
Jan. 3...	1732	60	—	0	—	84° F. (28·8° C.).
„ 7...	1737	40	+	3	19	84° F. (28·8° C.).
Feb. 10...	1853	25	+	5	24	84° F. (28·8° C.).
„ 24...	1950	33	+	6	21	84° F. (28·8° C.).
April 29...	2115	40	—	4	—	84° F. (28·8° C.).

* 'Roy. Soc. Proc.,' B, vol. 87, p. 1 (1913).

Two hundred and forty flies were used and twenty-four infected flies found—10 per cent. The first two experiments were carried out at the ordinary temperature of the laboratory; in the others the flies were kept in the incubator.

Details of the Five Positive Experiments.

The following Tables give the principal details in the carrying out of the five positive experiments. They were all carried out with laboratory-bred flies:—

Table II.

Expt.	Day of expt.	Procedure.	Remarks.
546	1-3	22 flies fed on <i>T. pecorum</i> -infected dog.	Goat 559 became infected on the 60th day; Dog 880 on the 82nd day. All flies dissected; 4 found infected.
	4	Starved.	
	5-62	Fed on clean Goat 559.	
	63	Starved.	
	64-82	Fed on clean Dog 880.	
524	1-5	20 flies fed on <i>T. pecorum</i> -infected rat.	Trypanosomes first appeared in blood of Dog 541 on the 44th day. All flies dissected; 2 found infected.
	6	Starved.	
	7-44	Fed on clean Dog 541.	
1737	1-3	40 flies fed on <i>T. pecorum</i> -infected dog.	Trypanosomes first appeared in blood of Dog 1750 on the 26th day. All flies dissected; 3 found infected.
	4	Starved.	
	5-27	Fed on clean Dog 1750.	
1853	1-3	25 flies fed on <i>T. pecorum</i> -infected dog.	Trypanosomes first appeared in blood of Goat 1903 on the 31st day. 25 flies dissected; 5 found infected.
	4	Starved.	
	5-25	Fed on clean Goat 1903.	
1950	1-8	33 flies fed on <i>T. pecorum</i> -infected goat.	Trypanosomes first appeared in blood of Dog 1973 on the 28th day. All flies dissected; 6 found infected.
	9	Starved.	
	10-29	Fed on clean Dog 1973.	

It would appear from these five positive experiments that a period of from 19 to 53 days may elapse before the cycle of development of *Trypanosoma pecorum* in *G. morsitans* is complete and the fly becomes infective.

Details of the Two Negative Experiments.

The following Table shows the method of procedure in carrying out the two negative experiments:—

Table III.

Expt.	Day of expt.	Procedure.	Remarks.
1732	1-2 3 4-39	60 flies fed on <i>T. pecorum</i> -infected dog. Starved. Fed on clean Dog 1736. (Experiment stopped.)	Dog 1736 never showed trypanosomes. 25 flies remained alive; used for another experiment. Only 12 flies dissected; all negative.
2115	1-4 5-6 7-8	40 flies fed on <i>T. pecorum</i> -infected rat. Starved. Fed on clean Monkey 2066. (Experiment stopped.)	Monkey 2066 never showed trypanosomes. All flies dissected; 4 found infected. Experiment stopped on account of death of most of the flies.

RESULT OF THE DISSECTION OF THE INFECTED FLIES.

The following Table gives the result of the dissection of the infected flies found in the positive experiments. The second column gives the number of days between the first infected feed of the fly and its death and dissection:—

Table IV.—Laboratory-bred Flies. Positive Experiments.

Expt.	Time, days.	Proboscis.		Proventriculus.	Crop.	Fore-gut.	Mid-gut.	Hind-gut.	Salivary glands.
546	30	—	—	—	—	+	+	+	—
546	64	—	—	—	—	++	++	++	—
546	84	—	—	—	—	++	++	++	—
546	84	++	++	++	++	++	++	++	—
524	27	—	—	—	—	—	++	++	—
524	55	+	+	—	—	++	++	++	—
		Labial cavity.	Hypopharynx.						
1737	27	++	++	++	++	++	++	++	—
1737	28	+	—	+	—	++	++	+	—
1737	30	++	++	++	—	++	++	++	—
1853	17	++	++	++	—	++	++	++	—
1853	22	—	—	—	—	+	++	+	—
1853	23	+	—	+	—	++	++	++	—
1853	25	++	++	+	—	++	++	++	—
1853	26	++	++	+	—	++	++	++	—
1950	17	—	—	+	—	++	++	++	—
1950	19	++	++	—	—	++	++	++	—
1950	24	—	—	—	—	—	+	—	—
1950	26	++	++	+	—	++	++	++	—
1950	31	++	++	+	—	++	++	++	—
1950	31	++	++	++	—	++	++	++	—

In Experiments 546 and 524 there was no special examination of the hypopharynx; it is included in the general term "Proboscis." It was only

after the importance of the hypopharynx became evident that an examination of these separate parts of the proboscis was made.

In Experiment 546 only one infective fly was found. In Experiment 524 two infected flies were found; in one of these the development was incomplete, in the other complete. In 1737 two flies were infective, in 1853 three, and in 1950 four. In not a single fly was any invasion of the salivary glands noted.

The following Table gives the result of the dissection of the infected flies in the negative experiments :—

Table V.—Laboratory-bred Flies. Negative Experiments.

Expt.	Time, days.	Proboscis.		Proventri- culus.	Crop.	Fore- gut.	Mid- gut.	Hind- gut.	Salivary glands.
		Labial cavity.	Hypo- pharynx.						
2115	9	—	—	—	—	—	+	—	—
2115	9	—	—	—	—	—	++	—	—
2115	9	+	—	+	—	+	++	++	—
2115	11	—	—	+	—	+	++	+	—

In the negative Experiment 1732 all the flies were found to be negative.

In Experiment 2115 four infected flies were found, but in none of these had the development reached the hypopharynx; none of them were infective.

From a consideration of these tables it will be seen that *T. pecorum* belongs to the same group as *T. simiae* as regards its development in *G. morsitans*. This development takes place at first in the intestine, then passes forward into the labial cavity, and finally invades the hypopharynx and there is completed.

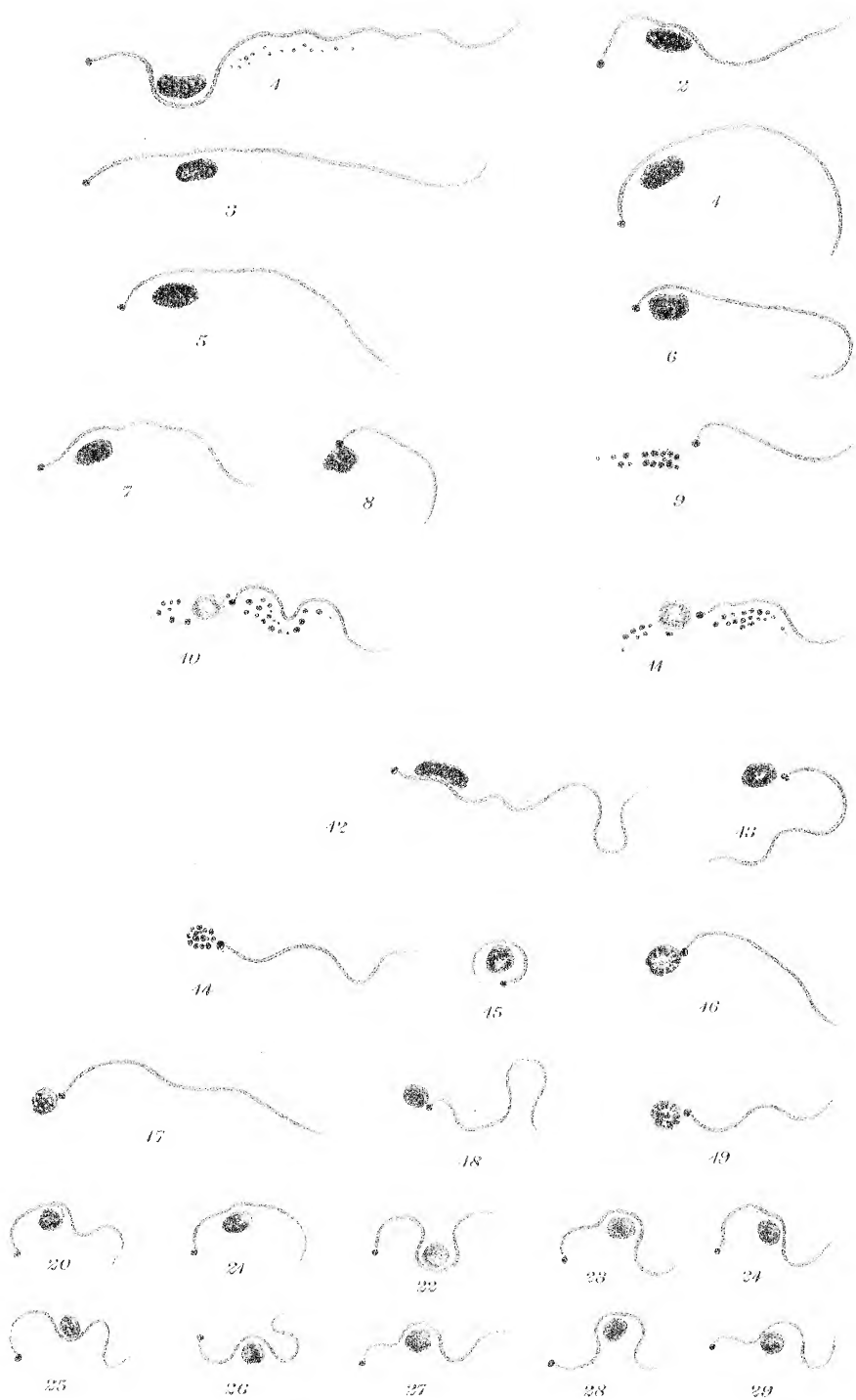
THE TYPE OF TRYPANOSOMES FOUND IN THE INFECTED FLIES.

Plate 2 represents the developmental forms of *T. pecorum* in *G. morsitans*. In regard to the forms found in the intestine, it may be said that these are indistinguishable from the developmental forms of other pathogenic trypanosomes, and what was written in regard to *T. simiae** is equally applicable to *T. pecorum*.

Figs. 1 and 2 are forms from the proventriculus, and represent the dominant intestinal trypanosome forms passing forward to the labial cavity.

Figs. 3-8 represent early forms found in the labial cavity. These were seen adhering singly by their flagella to the labrum.

* 'Roy. Soc. Proc.,' B, vol. 87, p. 65 (1913).



Trypanosoma pecorum
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Figs. 9-11 are the ordinary forms found clinging by their flagellar ends to the labrum. It will be seen that they have assumed the crithidial stage, a stage which seems to be a *sine qua non* in the final stages of the cycle of development of all the pathogenic trypanosomes, and the interpretation of which is still obscure.

Figs. 12-19 are various forms other than "blood forms" which have been squeezed out of the proboscis of a living infective fly. Fig. 15 appears to be encysted.

Figs. 20-29 are "blood forms" from the hypopharynx of dead infective flies, and also from living flies induced to salivate on a cover-glass. They represent the final stage in the cycle of development and are the only infective forms.

CONCLUSIONS.

1. That *T. pecorum* is capable of passing through a cycle of development in *G. morsitans*, the flies becoming infective some 20 days after feeding on an infected animal.

2. That *T. pecorum* belongs to the same group as *T. simiae*, the development taking place at first in the gut and afterwards passing forward into the labial cavity and finally into the hypopharynx.

3. That the final stage of the development only occurs in the hypopharynx, where the trypanosomes revert to the "blood form" and become capable of setting up infection if injected under the skin of healthy animals.

DESCRIPTION OF PLATE.

(See also pp. 36 and 37 above.)

Figs. 1 and 2, trypanosome forms from proventriculus.

Figs. 3-8, early infection of the labrum; the flagellates still retain the trypanosome characteristics.

Figs. 9-11, ordinary crithidial forms found adhering in masses to the labrum.

Figs. 12-19, other forms from labial cavity.

Figs. 20-29 represent the final stage of the development in the hypopharynx--the infective or "blood form."

Stained Giemsa. × 2000.



Trypanosoma cruzi Disease in Man in Nipponland
 Development in *Glossina brevipalpis*